CLAIMS

1. A method for forming a semiconductor device, comprising:

providing a semiconductor substrate;

forming an insulating layer over the semiconductor substrate;

forming a conductive layer over the insulating layer;

forming an organic anti-reflective coating (ARC) layer over the conductive layer;

depositing a tetra-ethyl-ortho-silicate (TEOS) layer over the organic anti-reflective coating layer;

depositing a photoresist layer over the TEOS layer; and

patterning the photoresist layer to form a patterned photoresist structure.

2. The method of claim 1, wherein the organic ARC layer comprises amorphous carbon.

3. The method of claim 1, wherein the organic ARC layer is deposited to be between about 300 to 700 angstroms thick.

4. The method of claim 1, wherein the TEOS layer is formed on the organic ARC layer at a temperature of about 250 to 350 degrees Celsius.

5. The method of claim 1, wherein the TEOS layer is formed on the organic ARC layer at a temperature of about 350 degrees Celsius or less.

6. The method of claim 1, wherein the TEOS layer is between about 200 and 300 angstroms thick.

7. The method of claim 1, further comprising laterally trimming the patterned photoresist structure to decrease a lateral dimension of the patterned photoresist structure.

8. The method of claim 7, further comprising removing at least a portion of the TEOS layer from around the patterned photoresist structure.

9. The method of claim 8, further comprising removing at least a portion of the organic ARC layer from around the patterned photoresist structure to create a patterning stack.

10. The method of claim 9, further comprising removing the conductive layer from around the patterning stack to create a gate electrode under the patterning stack.

11. The method of claim 10, further comprising removing the patterning stack.

12. The method of claim 1, wherein the patterning is performed using light having a wavelength of 248 nanometers or less.

13. The method of claim 1, wherein the conductive layer comprises polysilicon.

14. The method of claim 13, further comprising:

forming sidewall spacers on the gate electrode; and

diffusing source/drain regions into the substrate.

15. A semiconductor device comprising:

a semiconductor substrate;

an insulating layer formed over the semiconductor substrate;

a conductive layer formed over the insulating layer;

an organic anti-reflective coating (ARC) layer formed over the conductive layer;

a tetra-ethyl-ortho-silicate (TEOS) layer formed over the organic (ARC) layer; and

a patterned photoresist layer formed over the TEOS layer.

16. The semiconductor device of claim 15, wherein the organic (ARC) layer comprises amorphous carbon.

17. The semiconductor device of claim 15, wherein the organic (ARC) layer is deposited to be between about 300 to 700 angstroms thick.

18. The semiconductor device of claim 15, wherein the TEOS layer is formed on the organic (ARC) layer at a temperature of about 250 to 350 degrees Celsius.

19. The semiconductor device of claim 15, wherein the TEOS layer is formed on the organic (ARC) layer at a temperature of about 350 degrees Celsius or less.

20. The semiconductor device of claim 15, wherein the TEOS layer is between about 200 and 300 angstroms thick.

21. The semiconductor device of claim 15, wherein the patterned photoresist layer is for forming a gate electrode of a metal-oxide semiconductor transistor.

22. The semiconductor device of claim 15, wherein the conductive layer comprises polysilicon.

23. A method for forming a semiconductor device, comprising:

providing a semiconductor substrate;

forming an insulating layer over the semiconductor substrate;

forming a conductive layer over the insulating layer;

forming an organic anti-reflective coating (ARC) layer over the conductive layer;

depositing a silicon oxide cap layer using a organosilane based precursor over the organic ARC layer;

depositing a photoresist layer over the cap layer; and

patterning the photoresist layer to form a patterned photoresist structure.

24. A method for forming a semiconductor device, comprising:

providing a semiconductor substrate;

forming an insulating layer over the semiconductor substrate;

forming a conductive layer over the insulating layer;

forming a stoichiometric silicon nitride layer over the conductive layer;

forming an organic anti-reflective coating (ARC) layer over the stoichiometric silicon nitride layer;

forming a silicon-rich oxide layer over the organic ARC layer;

depositing a photoresist layer over the silicon-rich oxide layer; and

patterning the photoresist layer to form a patterned photoresist structure.

25. The method of claim 24, wherein the silicon-rich oxide layer comprises at least a trace amount of nitrogen.

26. A method for forming a semiconductor device, comprising:

providing a semiconductor substrate;

forming an insulating layer over the semiconductor substrate;

forming a conductive layer over the insulating layer;

forming an organic anti-reflective coating (ARC) layer over the conductive layer;

forming a stoichiometric silicon nitride layer over the conductive layer;

forming a silicon-rich oxide layer over the stoichiometric silicon nitride layer;

depositing a photoresist layer over the stoichiometric silicon nitride layer; and

patterning the photoresist layer to form a patterned photoresist structure.

27. The method of claim 26, wherein the silicon-rich oxide layer comprises at least a trace amount of nitrogen.